

**A MALIGNANT TYPE OF PSEUDOMYXOMA PERITONEI PENETRATING THE SPLEEN AND COLON.\***

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THE number of cases of pseudomyxoma peritonei recorded is so great that the report of a simple case is no longer justifiable. I have been unable, however, in the search of the literature to find a single case which presents the same pathological picture as one of the cases which I desire to report.

To the French belong the credit of having first described these tumors; but it was not until 1874 that Beinlich, in the Charité records, reported in detail two cases, describing the process as a myxomatous degeneration of the peritoneum. This explanation was generally accepted by Virchow and others, until 1885 Werth in his classical paper gave an entirely different interpretation of the pathology. Donat confirmed these findings two years later.

Werth introduced the term pseudomyxoma peritonei, which is accepted even to-day, but not in the sense of the original article, which described one distinct process. At the present time several separate and distinct pathological conditions have been described. Strassman, as early as 1891, collected three distinct processes, namely: 1. Myxomatous degeneration of the peritoneum (Virchow, Wendler). 2. Rupture of the original tumor with escape of the gelatinous substance, which becomes intimately adherent to the peritoneum (Werth). 3. Development of cysts with the same structure as the original cyst (implantation of Olshausen).

The myxomatous degeneration of the peritoneum was more or less discarded following the monograph of Werth, and has up to the present time found few adherents. Wendler in

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1896 became a strong advocate of this view. Westphalen claims that the microscopical pictures have been falsely interpreted, and regards the condition as due to the absorption of the gelatinous substance into the lymphatics of the peritoneum.

While the question of the existence of a myxomatous degeneration is very doubtful, and was certainly not noted in the two cases to be reported, the findings of Werth and, of more importance, the development of implantation cysts, were observed in both cases. It will be seen from the report of the first case, that further subdivision of the group of implantation cysts is necessary, for none of the reported cases are in any way similar, save probably the one reported by Polano, further mention of which will be made later.

CASE I.—Mrs. L.; age sixty-six years. Entered the hospital March 2, 1903, on account of an enlargement of the abdomen. Seen in consultation on the same day. Family history: Father died of paralysis at seventy-three years. Mother died at fifty-five years, of insanity. Several members of the immediate family were mentally unstable. Previous history negative. First menses at thirteen years. Menopause at fifty-one years; came gradually and with no pronounced symptoms. Has four children, all living and healthy. Patient has noticed enlargement of abdomen for two years. First noticed that left side was slightly larger than the right. For past few months has had a sensation of fulness. No pain at any time. Patient is 5 feet 2 inches in height; weight 164 pounds. Somewhat anæmic. Skin is very flabby. Examination of thorax is negative.

*Abdomen.*—The distention of the abdomen is symmetrical upon inspection. On palpation through the thick and resistant abdominal wall, one can detect, indistinctly, a tumor about the size of a child's head. Percussion gives dulness from umbilicus to the symphysis and extends more to the left than to the right side.

Vaginal examination shows the uterus high in the pelvis and larger than a senile uterus should be. Adnexa cannot be palpated. High in the abdomen, being reached with difficulty, a tumor can be felt, having no direct connection with the uterus. The examination, owing to the thick abdominal walls is unsatis-

factory. Urine negative. Blood: Hæmoglobin 75 to 80 per cent.; erythrocytes 3,600,000; leucocytes 9,800.

*Operation*, March 6, 1903, by Dr. McAlester. Median incision. At this point the cyst is adherent to the parietal peritoneum. The wall of the cyst is extremely thin and through the manipulation is ruptured. From it there escapes a large quantity of a mucoid substance. Palpation is continued by placing the hand in the cyst cavity. The cyst is found adherent to the abdominal viscera from the liver to the pelvis, practically filling the abdominal cavity. Just above the uterus is noted a number of small cysts, making a mass about the size of a foetal head. It is this which was felt upon vaginal examination. The large cyst, filled with the gelatinous substance, had not been palpated. Cyst is drained with gauze and tubes. Peritoneal cavity as such is not opened.

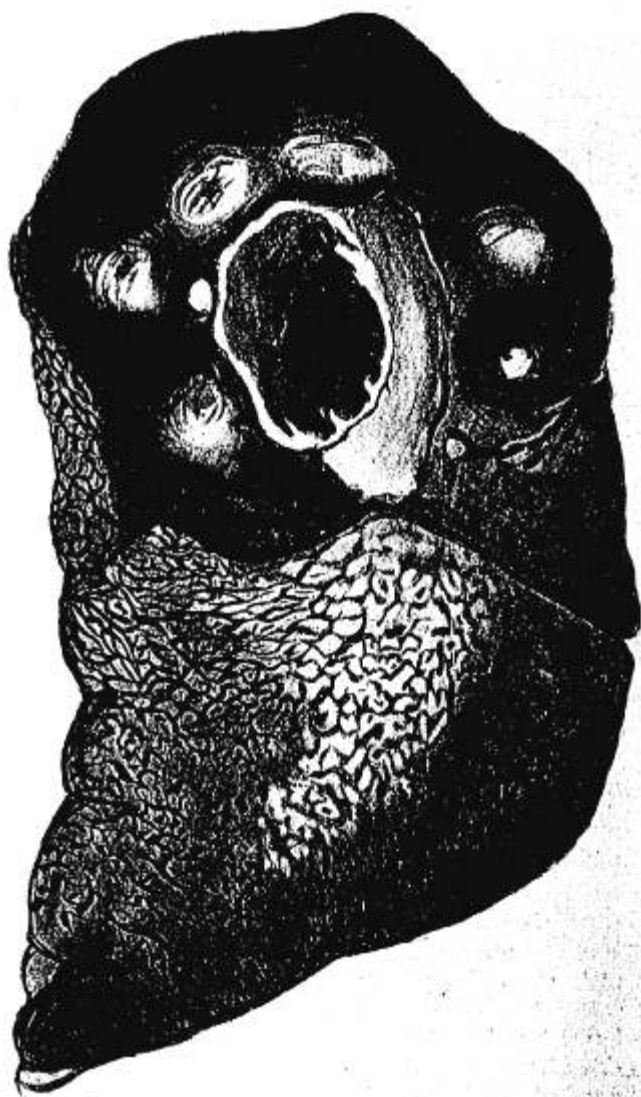
Following the operation the patient was nauseated for a few days. She refused absolutely to take food and expressed the desire to die. Showed great mental depression. She finally died of exhaustion on March 16, thirteen days after operation, having run practically an afebrile course.

*Autopsy* by Dr. Miller. Abdominal findings alone are of interest. Median incision extending from the symphysis to the umbilicus. Through the lower half drainage of gauze. Upon removal of same a gelatinous substance exudes. When the abdominal cavity is opened this same substance is found adherent to the peritoneum practically throughout. Visceral peritoneum markedly injected.

The tumor is removed from the cavity along with the pelvic viscera. All viscera of the abdomen are adherent through the medium of the gelatinous substance. Rectum and bladder are normal.

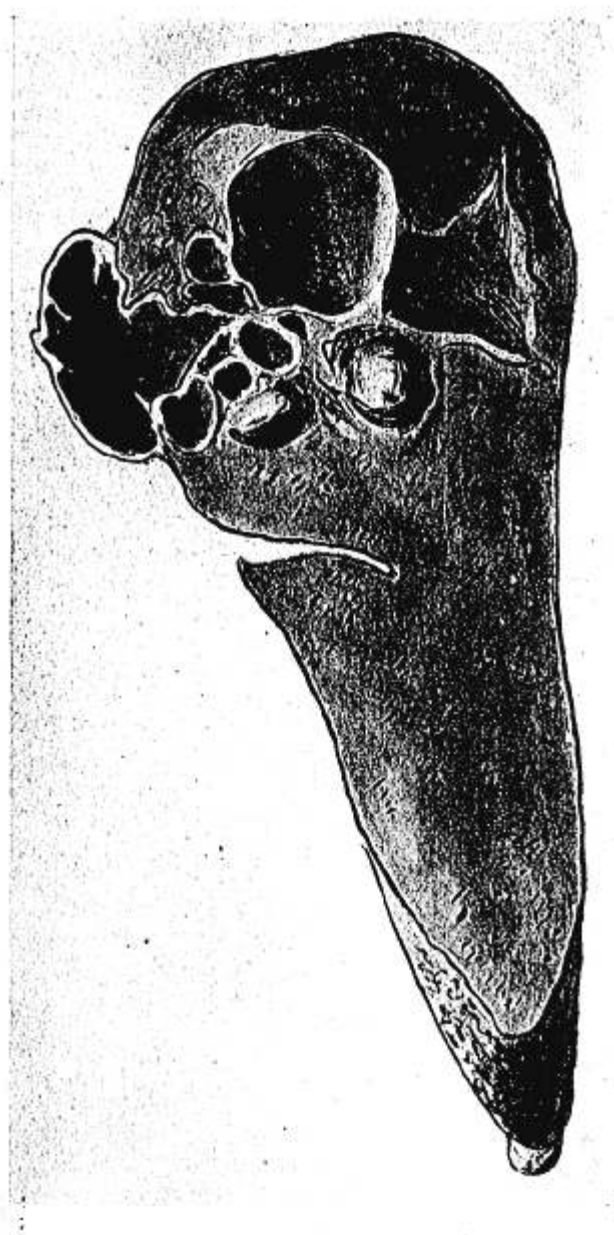
The uterus is large for a senile uterus. Its peritoneal surface is covered by a shaggy grayish-red fibrinous coat. The right ovary, round ligament and broad ligament are beset with small clear cysts and a delicate fibrinous exudate. The left tube at its abdominal end is swollen, and the vessels are injected. The ovary of that side cannot be distinguished from the tumor mass. On the left tube, and surrounding it, is a mass made up of small cysts measuring 4 x 8 x 2.3 cm. This mass is continuous with the main tumor, which measures 25 x 25 x 8 cm. and weighs 2,400 grams.

FIG. 1.



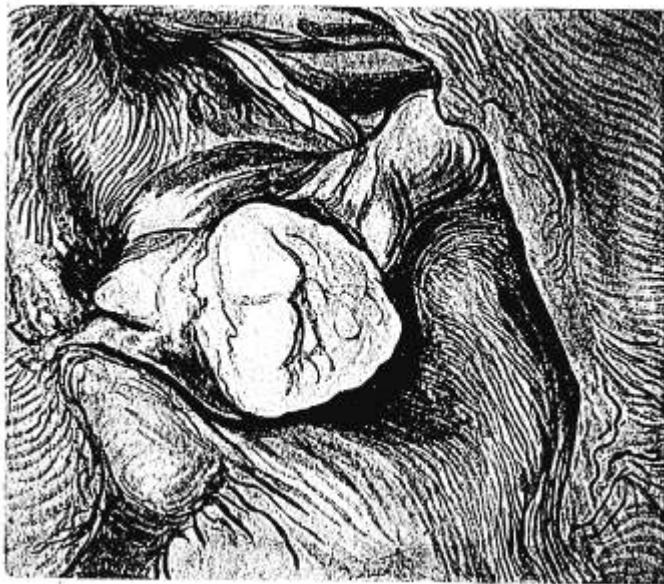
Spleen.—Showing involvement of entire pole of spleen by cysts.

FIG. 2.



Spleen.—Section through spleen, showing the encroachment upon splenic tissue by the cysts.

FIG. 3.



Caecum showing dilatation of appendiceal opening and the escape of the pseudomucin into the bowel.

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The tumor shows several perforations on its anterior aspect and from them this jelly exudes. The edges of the cyst wall at the point of perforation are everted. At the opening in the cyst wall made by the knife, the gelatinous substance is covered by a fibrinous exudate. The cyst is multilocular. The peritoneum of the anterior abdominal wall is covered with a shaggy grayish coat intermixed with the jelly. The peritoneum of the posterior cul-de-sac contains a number of small cysts and free pseudomucin.

The left kidney is pale and deformed. On its posterior aspect is a cyst, probably a retention cyst. The right kidney has an adherent capsule. The kidney substance is granular and the cortex pale.

Liver measures  $25 \times 17 \times 7$  cm. The surface is covered in great part by the gelatinous substance. The right lobe is greatly constricted and reduced to a mere fibrinous band from which it is suspended. On section it is of a pale color and the lobes are indistinct.

Spleen is fairly imbedded in this gelatinous substance. It is irregular in shape, due to the growth of a cystic tumor (Fig. 1). Spleen measures  $11 \times 5.5 \times 4$  cm. On section it is found to contain cysts (Fig. 2) measuring  $5 \times 2.5$  cm. The contents of these cysts are the same in appearance and consistency as the primary tumor. The cyst has grown directly into the splenic tissue, destroying the latter in its growth. Trabeculae and Malpighian bodies are conspicuous in the much reduced splenic tissue. Weight of spleen 130 grams.

Large intestine: Cæcum. At the ileocæcal valve, corresponding to the region in which we would expect to find the appendix, is a large tumor mass, measuring  $4 \times 3 \times 4$  cm. Careful dissection fails to reveal the appendix, which is in all probability involved in the tumor mass. On the external surface the tumor, which is cystic, has ruptured at several points and from these this same gelatinous substance exudes. The cyst is not limited entirely to the cæcum, but a small daughter cyst about the size of a walnut has grown between the layers of the wall of the ileum, as is also true in the cæcum. On the mucous surface of the cæcum, a little below and external to the ileocæcal valve, is an opening (Fig. 3) measuring  $1.5 \times 2$  cm., from which this same gelatinous substance escapes. The opening has a perfectly regular border, presenting a very different picture in this respect

from the rupture on the ascending colon, and seems to be a mere distention of the normal appendiceal opening. A section through the entire tumor mass shows it to be a multilocular cystic tumor with the same microscopical appearance as the original tumor. Twenty-five centimeters above this point on the ascending colon, corresponding to the hepatic flexure, is a perforation of the colon on the anterior internal band. It measures  $2 \times 2.5$  cm. on the mucous surface. The border of the perforation is very irregular and shows small pieces of gelatinous substance adherent to same. Most of the cystic contents have been lost. The peritoneal surface of the cyst also shows rupture. The escape of faecal contents was prevented by the presence of the gelatinous substance. A distinct cyst wall can be noted in the upper area and is of harder consistency than the remainder of the cyst wall. The wall of the intestine appears infiltrated.

*Microscopic Examination.* A number of pieces from the original tumor, omental and peritoneal metastases were taken for examination. The findings correspond in every detail to the cases commonly described—being a simple pseudomucin cystadenoma.

*Spleen.*—As can be recognized macroscopically, the metastatic cysts penetrate deep into the unchanged splenic tissue. No round-cell infiltration. The structure of the cysts is the same as in the metastatic cysts in other parts and as the mother cyst. With few exceptions, the cyst contents, taking a typical pseudomucin stain, is separated from the splenic tissue by the connective tissue capsule of the cyst, with or without its epithelial lining. At some points the entire cyst wall is broken through and the gelatinous substance is found in direct contact with the splenic tissue.

*Large Intestine.*—Pieces were taken from the cæcum and ascending colon at the points of perforation. The cysts are found to penetrate the layers of the intestine. There is a very slight round-cell infiltration. The mucous membrane, as well as the other layers of the intestine, do not take the stain well; but the nuclei of the cells can be recognized and no distinct degeneration is noted. The connective tissue layer of the cyst wall, in contrast to the tissue of the intestine, takes a pronounced stain. The epithelial lining of the cysts is for the most part lost. At points the gelatinous contents has broken through the capsule. Several pieces taken from the supposed opening of the appendix into the bowel, fails to reveal the mucous membrane on either surface.

In this case, a very rare condition has been observed in the spleen, cæcum and ascending colon. We find a process which has not hitherto been described, except in one case. This class of tumor has always been regarded as non-malignant; but



for such pathological conditions a new subdivision must be made. Polano reports a case which shows a somewhat similar process in the liver, but even here the same degree of malignancy does not exist. The cystic growth had penetrated deep into the liver along the connective tissue of the portal vein. The vessels themselves were not involved. The microscopic examination reveals an intact capsule of Glisson. These cysts show the same structure as the peritoneal and omental metastases. The boundary between the new growth and the liver cells is formed by cyst epithelium and connective tissue. At several points the capsule is broken through and the gelatinous substance is found in the liver parenchyma.

The class of metastases noted by Olshausen, in which cysts with the same structure as the mother cysts have been implanted upon the peritoneum and omentum, has been frequently noted. In no case, however, has the intact peritoneum been destroyed or viscera penetrated.

In the case of Palano, the cells of the mother cyst followed the connective tissue of the portal vein. This process in itself is not so remarkable, for we have similar processes in the cases of Baumgarten, Sanger and Peiser, in which following the use of the trocar, metastatic cysts developed along its tract or developed in an old abdominal scar. The microscopic examination in Polano's case reveals in places a penetration of the liver tissue by the cysts, and it is this which most naturally makes one think of malignancy.

The spleen in my case shows even a different process. Here the cyst has developed upon an intact peritoneum, has penetrated it and destroyed the splenic tissue. True, the metastatic cysts have not developed in distant organs through the medium of the lymphatics and blood vessels, but this is not the only test of malignancy. There is a similar process in the malignant growths of the stomach, with metastases in the ovaries, as a result of direct implantation, as shown by Krause and others. We are accustomed in all malignant processes to see direct implantation.

The process in the cecum and ascending colon represents

a similar malignant condition. At first glance one might regard the perforation of the bowel as the result of a direct pressure necrosis, but the microscopic examination removes all doubt on this score. Siinger reported the first case of perforation of the intestine. He regarded it as the result of pressure atrophy. Peiser reports a case with two perforations and offers a similar explanation. In his case, the tumor became infected, forming firm adhesions to the intestines and parietal peritoneum, so that the intestine could not escape the pressure from the growth of the tumor. Upon examination the microscope failed to reveal any growth of the cyst into the serosa, muscularis or mucosa.

In the case of Martin, recently reported, there was a perforation of the bladder and rectum and fistulous openings in the ileum and sigmoid. There was an absence of any infection of the cyst. Microscopic examination of the bladder and rectum demonstrated a gradual thinning of the walls up to the points of perforation. Active process in the walls was not noted. The tumor, fixed in the pelvis, developed adhesions to the surrounding viscera and exerted a constant pressure against the pelvic wall. The fistulous communication between the cyst and ileum and sigmoid were inflammatory, probably due to an infection by the bacillus coli.

The explanation offered in the previous cases, will not hold true in my case. We have here an active process. The pseudomyxomatous cysts have become implanted upon the intestine, destroyed the wall by an active process and thus produced the perforation.

The involvement of the appendix and cæcum is such that a differentiation of the parts is impossible. All that can be said is that the appendix is involved, possibly primarily, and from this the cæcum and ileum have become affected. Westphalen reports a case in which the appendix is distended into a sausage-shaped tumor, 16 cm. long and 7 cm. thick, through which the gelatinous substance can be seen. Microscopically small pseudomucin cysts are seen within its lumen and at places within its wall. The appendix is distended with jelly and is

shut off from the cæcum by a membrane, probably the result of a previously existing atresia. Westphalen regards this as an implantation metastasis.

Fränkel has observed a case of true myxomatous degeneration of the appendix, without any similar process in the ovary or other viscera.

We have in this active destruction of the spleen and intestine a pathological process, differing from the three processes collected by Strassman. An ovarian cyst, regarded ordinarily as a benign type, produces typical implantation metastases, with the destruction of the tissue upon which they are implanted. This picture we are accustomed to recognize as a malignant process, and should be so accepted in this case. In Polano's case, which did not begin to show the same extent of destruction of tissue, attention was called to the necessity of recognizing another class of these metastases. He has dignified it by the name "*Cystadenoma malignum pseudomucinosum peritonei*," to differentiate it from the simple type without destruction of tissue or penetration of intact epithelium. These cases should serve to emphasize the necessity of recognizing the malignancy of a few of these tumors.

The second case has a typical history of rupture of the cyst with non-malignant metastases.

CASE II.—Miss G.; age sixty-five years. Admitted to the hospital April 25, 1904. Was seen in consultation the following day. Patient comes to the hospital on account of an enlargement of the abdomen. Has had epilepsy all her life. This has left her quite an invalid and has greatly impaired her mind. About three years ago she had what was diagnosed by her physician as peritonitis with effusion. Was very sick but made good recovery. About two months ago she noticed that the abdomen was larger than usual. Paid little attention to it at first, but it grew so rapidly that she finally called a physician. This was about one month ago and since this time the abdomen has increased  $1\frac{1}{2}$  inches.

*Examination.*—Thorax negative. Abdomen prominent; 37 inches in circumference; tympany in flank; dull below umbilicus

in median line and to the left; nothing palpable; at times one thinks he notes fluctuation. Vaginal examination negative. Urine: Trace of albumin and hyaline casts.

Examination under an anæsthetic reveals a tumor of the right ovary the size of a double fist. It is very high in the abdomen and barely palpable from below. It requires a bimanual examination before it can be recognized.

*Diagnosis.*—Ovarian tumor; chronic epilepsy; dementia.

Operation was refused. Death occurred May 23, the immediate cause being hæmorrhage from the stomach. During ten days before her death she suffered from repeated hæmorrhage, and also passed blood by the bowels.

*Autopsy* by Dr. Miller.—Upon opening the abdomen, there was removed from its cavity a large quantity of gelatinous substance. This comes from a ruptured cyst of the right ovary. The cyst was a multilocular one, with a comparatively small pedicle. On both the parietal and visceral peritoneum firm union of the gelatinous substance was noted.

Lungs and heart negative, except for adhesions of the right pleura.

Spleen.—Capsule thickened. Adherent to omentum, stomach and diaphragm.

Liver somewhat smaller than normal and surface granular. Gall-bladder distended and contains several small stones. Ducts free. On cut surface of liver a marked increase of connective tissue was noted.

Kidneys.—Small, lobulated and surface granular. Capsule adherent. Cortex shrunken. Several small retention cysts.

Intestines normal. Omentum contained number of small cysts.

Œsophagus.—The lower end of the œsophagus contained a great many dilated veins and several ulcers size of a pea. It was from this area that the hæmorrhage occurred. Ulcers were several inches from the cardiac end of the stomach.

Stomach negative. Arteriosclerosis quite marked. Uterus atrophic. Left ovary size of almond, sclerotic and atrophic. Small cysts on broad ligament.

*Diagnosis.*—Pseudomucin cystadenoma of the right ovary, with rupture. Pseudomyxoma peritonei. Chronic interstitial nephritis. Ulceration and varicose condition of veins of œsophagus. Splenitis.

In none of the cases of pseudomyxoma peritonei was a diagnosis made before the operation, except in a few in which the trocar had been employed. There seems to me to be a complex of symptoms, which if carefully noted, make it possible to diagnose both the nature of the tumor and the rupture.

In some few cases it is possible to have symptoms which indicate the exact time of the rupture; but this is the exception. If the case has been previously observed and a diagnosis of tumor made, it would easily be possible to diagnose the rupture from the apparent changes. These cases are usually not seen until the rupture has occurred.

I find a few cases recorded, in which the patient reports having had an acute attack of pain in the abdomen, general tenderness, nausea and vomiting. Following these a rapid growth of the abdomen was observed. This latter condition is of great diagnostic value, for in all cases careful histories will show a very rapid and pronounced increase in the size of the abdomen, extending over a period of not more than a few months in any case. This growth is more pronounced than in any of the abdominal tumors, save those in which a malignant degeneration exists. The probable explanation of the rapid increase in the size of the abdomen, is the abundant secretion of the pseudomucin, made possible by the relief of the pressure on the secreting cells of the cyst.

Symptoms of peritonitis are sometimes present, but always without noteworthy temperature. Usually dating from the period of rupture and rapid growth, there is noted emaciation, anorexia and occasional disturbance in the bowels, either a constipation or diarrhœa. These symptoms may all be accounted for by the disturbance of the absorptive function of the intestinal tract, as a result of the blocking of the lymphatics.

Upon inspection, a rather symmetrical increase is observed, since the gelatinous substance is distributed throughout the peritoneal cavity. The abdomen is broader than high, not having the barrel shape ordinarily found in large tumors; the shape being more like that of free ascitic fluid. The epigastric region is distended equally with the hypogastric and umbilical

regions, a condition not ordinarily found in pelvic tumors. This is to be explained by the constant collection of a large amount of gelatinous substance in this region.

Palpation offers the most characteristic signs. The palpable tumor is frequently so small that it is recognized with difficulty, especially in those cases with thick abdominal walls. The size of the tumor does not correspond with the pronounced symptoms and especially not with the rapid growth of the abdomen. Rarely is there found a palpable tumor larger than a foetal head. Ovarian cysts of this size, one is accustomed to find in the pelvic canal. In these cases they are usually found high in the abdomen; sometimes so high that it is impossible to reach them through the vagina. This is very important as a diagnostic sign.

The general contour of the tumor if large is irregular, making a diagnosis of a multilocular growth possible. The "Kolloidknittern" of Olshausen, due to the escape of the colloid substance from one cyst cavity to another, may be observed. Pfannenstiël does not regard this symptom of value and claims to have found it with a fibroid and with a distended bladder.

Fluctuation is uncertain, and it is just this uncertainty which makes it of diagnostic value in some cases. We might call it a pseudo-fluctuation. When present it is a large wave and usually disappears entirely by breaking the wave with the hand. I find in a number of cases this symptom is noted and in each case the uncertainty of the fluctuation is commented upon. At times when one strikes in such a way as to get just the proper motion of the jelly, a true fluctuation is noted; while again repeated attempts fail to produce fluctuation, even though the patient has not changed her position. The rupture of the partition walls of the cysts, described by Olshausen as giving the "Kolloidknittern," may be a factor in determining the presence or absence of fluctuation.

Auscultation offers little, except in occasional cases the "Kolloidknarren" of Oldshausen may be detected.

On percussion there is dulness in the lowest points and a dull tympanitic note in the epigastric region. In no case do I

find record of complete dulness in the epigastrium. Upon changing the position of the patient, the dulness does change, but as a rule only slightly. At times small areas of dulness are found in the middle of the abdomen, with distinct areas of tympany around them. Distinct tumor outline can rarely be percussed. The percussion signs simulate those in general of an encysted fluid in peritonitis, but the distinction can readily be made, in that none of the other symptoms of such a peritonitis exist. The general dulness is always greater than the palpable tumor would permit one to expect.

The vaginal examination may assist in confirming the abdominal findings. The height of the tumor in the abdomen is especially noteworthy. In a number of cases this was noted, in that the tumor could scarcely be palpated by the bimanual examination. In our second case, an anæsthetic was necessary before the tumor could be recognized, either by abdominal or vaginal examination. Even in those cases in which the rupture occurs in the cephalic pole of the tumor, it tends to take this high position, unless prevented by an intraligamentous growth or adhesions. In some cases the gelatinous substance, which always fills the posterior cul-de-sac, can be palpated by vaginal examination.

The recognizing of the pseudomucin in the stools might be possible in those cases with perforation of the bowels.

The negative findings with the trocar, should one still persist in its use, would be of value.

The following scheme will show the points of distinction in the differentiation of ovarian cysts and the pseudomyxoma peritonei:

<i>Ovarian cyst.</i>	<i>Pseudomucin cystadenoma with rupture</i>
No general symptoms.	General symptoms.
Slow growth of abdomen.	Rapid growth.
No pain, unless torsion of the pedicle.	Pain usually at time of rupture.
No peritonitis, unless torsion of pedicle,—when all symptoms of peritonitis are present.	Some symptoms of peritonitis. No temperature.

## Inspection of abdomen:

- a. Asymmetrical unless the entire abdomen is filled by cyst.
- b. Abdomen rounded. Flat in flanks with patient in recumbent position.

## Percussion:

- a. Dulness over abdominal prominence only.
- b. Tympany in flanks and epigastrium.
- c. No change in percussion with change of position.
- d. Fluctuation.

## Palpation:

- a. Tumor can be outlined by palpation.
- b. Regular contour.
- c. Tumor in pelvis when small.

## Auscultation:

Negative.

## Vaginal examination.

- a. Tumor readily palpable.
- b. Negative.

Exploratory puncture positive.

## Inspection of abdomen:

- a. Symmetrical.
- b. Abdomen flat, bulging in flanks.

## Percussion:

- a. Dulness not in proportion to size of tumor.
- b. Dulness in flanks, reduced tympany in epigastrium.
- c. Change.
- d. Pseudo-fluctuation.

## Palpation:

- a. With difficulty.
- b. Irregular.
- c. Palpable portion high in abdomen.

## Auscultation:

"Kolloidknarren" of Olshausen may be present.

## Vaginal examination:

- a. Palpated with difficulty.
- b. Pseudomucin sometimes palpable in cul-de-sac.

Exploratory puncture negative.

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